The Application of Total Quality Methods in Student Team Development

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The College of Engineering (COE) and the Department of Industrial and Manufacturing Engineering (IME) at Oregon State University (OSU) are committed to a philosophy of continuous improvement in curricula development. With our active industrial advisory boards and as a member of the IBM/TQM University Partnership, we have established an effective communication channel with a wide range of practicing engineering professionals.

One of the primary objectives developed as a result of these interactions is the increased use of student teams in both instructional and advisory roles. Both COE and IME have been using students to help evaluate teaching and in the promotion and tenure process for some time. We are now actively initiating a program to help in instructional process improvement. Students are serving as facilitators on TQM teams and in the fall terms of 1994 and 1995 senior engineering students were used to assist teams in the Engineering Orientation (ENGR 111) course. At the end of the terms, the student facilitators developed a report on their experiences and recommendations as to how the instructional process could be further improved.

Several of these students indicated that they would have benefitted from more formal facilitator training to supplement the practical experience they gained during the term. This feedback from the students highlighted the need for a formal course in facilitation. There are numerous other audiences for a fundamental course in facilitation. In a related effort, a process is currently being designed to help faculty understand how they can use teams more effectively in their classrooms.

The goal of this paper is to describe both the development process and a summary of the materials used for the student course in facilitation. The course topics include: facilitation fundamentals, such as how facilitation helps groups achieve their goals, intervening effectively in groups, meeting management, facilitating problem-solving, understanding group processes, and how to encourage creativity and innovation.

BACKGROUND

As stated in the previous section, student teams are being used in both instructional and advisory roles.
Both COE and IME have used student teams in a variety of capacities for a number of years. We are currently attempting to use the teams more extensively for assisting in identifying instructional process improvement opportunities. Students have been serving as facilitators on TQM teams and in the fall terms of 1994 and 1995 senior engineering students were used to assist teams in the Engineering Orientation (ENGR 111) course. The ENGR 111 facilitators are required to write a report at the end of the term detailing their experiences with facilitation and making recommendations on how to improve the course. From this student feedback, it became apparent that they were being expected to fill a role that they essentially had no formal preparation to fill. Facilitators were often selected for their maturity, professionalism, and industrial experience. However, these selection criteria were not necessarily related to the student’s ability to be an effective facilitator. In a sense, facilitators were selected because they were good role models, not because they had the skills and expertise to be effective facilitators. The following quote from a student report describes the need:

> Overall the only real suggestion that I would have for the mentor side of the class would be to include some training for the mentors on how to best help the students in the class. This could possibly include ... suggestions and examples of questions to be asking the groups so that we can help the group focus in on their process and help them stay organized. It would also be helpful to know the ways to help stimulate involvement of all of the group members. For the most part, all of the groups I saw had full participation but in some cases there were groups that were some what dominated by students who knew what they wanted to do and were very vocal with their opinions.

- Alan Freudenthal

Before discussing the course which was designed to meet this need, facilitation should be defined so that the reader will not confuse the term with more general team-building concepts.

**FACILITATION**

It is critical that engineering students understand the role of a facilitator in a group. It is not sufficient for our students to merely become better team contributors. They must also learn how to help others make greater contributions to the team effort. Scholtes (1988) states that a facilitator is responsible for keeping the meeting focused and moving. They can prevent the group from become bogged down in unproductive discussions. Scholtes further defines the facilitator's chief responsibilities as:

- Keeping the discussion focused on the topic and moving along,
- Intervening if the discussion fragments into multiple conversations,
- Tactfully preventing anyone from dominating or being overlooked, and
- Bringing discussions to a close.

Ordinarily, one would assume that the facilitator role would be filled by the project team leader, but increasingly experts are suggesting that indeed there are typically two types of leadership that are required in effective groups: task leadership and group process leadership. The most logical person to lead a team from a task or subject-matter perspective may not be the best person to lead the group from a group process
The key to the success of many teams is the ability to bring together a diverse group of individuals with a wide variety of talents, skills, interests, and personalities, and help these individuals become a successful team. Parker (1994) suggests that "process leadership involves bringing together the strangers who are working together for the first time, the colleagues who have worked together on other tasks, and the enemies who have been on opposite sides in past organizational battles." He suggests that some of the skills required to pull this transformation off include:

- Asking questions that bring out ideas and stimulate discussion,
- Using paraphrasing and other listening skills to ensure effective communication,
- Managing group discussions to encourage quiet members to participate and talkative members to adhere to limitations,
- Establishing an informal, relaxed climate where members feel free to candidly express their points of view,
- Using the consensus method to reach decisions on key team issues,
- Involving members in the setting of goals and objectives,
- Implementing good team meeting guidelines, including agenda planning and time management,
- Identifying and dealing with team members' dysfunctional behaviors,
- Celebrating the achievement of milestones and other team accomplishments, and
- Using recognition methods, task assignments, and other techniques to motivate team members.

Typically, in undergraduate engineering education a great deal of energy is focused on educating people to be qualified to be excellent task leaders. However, similar energy is not devoted to developing the students abilities to be effective group process leaders. Engineers in today's working environment are expected to be able to function effectively in cross-functional teams and concurrent engineering teams. Understanding how to effectively facilitate group interaction will help them be more successful in the work place. The course described in this paper was designed to address this need.

COURSE DESIGN

In order to address the needs described in the previous section, it is necessary to expose the students to both the theory and practice of effective facilitation. This is accomplished over two-ten week quarters. During the first quarter, the students enroll in a two hour course on facilitation. The course is structured to allow for one hour of lecture and a two-hour lab. The two-hour lab provides the opportunity for the students to participate in team-building exercises that they can use as facilitators to improve the functioning of their team. The majority of the team-building exercises are adapted from Scholtes (1988). Two texts are used for this course. They include:

An outline of the topics covered in the first quarter is shown in Table 1.

During the second quarter, the students enroll in a one-hour project course which requires them to apply their skills as a facilitator to aid an actual project team. A priority is given to project teams within the College of Engineering or at local industrial sites. Examples include serving as facilitators for the freshmen orientation courses, TQM teams, and departmental student advisory boards. In addition to serving as facilitators for these teams, the students are required to meet together on a weekly basis to share learnings from their facilitation experience. Thus, the course will be structured as a one-hour lecture course, and the students are required to maintain a journal to document their facilitation experience throughout the term.
TABLE 1. TOPIC OUTLINE FOR FACILITATION COURSE.

<table>
<thead>
<tr>
<th>Week</th>
<th>Session</th>
<th>Topic</th>
<th>Reading Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Understanding the Need for Teams in the New Business World</td>
<td>Scholtes, Chapter 1 Parker, Chapters 1-2</td>
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<tr>
<td>2</td>
<td>2</td>
<td>Identifying the Consequences of Management by Results</td>
<td>Team Building Exercise</td>
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<td>2</td>
<td>3</td>
<td>The Basics of Quality Improvement</td>
<td>Scholtes, Chapter 2</td>
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<tr>
<td>2</td>
<td>4</td>
<td>Obstacles to Quality Improvement</td>
<td>Team Building Exercise</td>
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<tr>
<td>3</td>
<td>5</td>
<td>Setting the Stage for a Successful Project</td>
<td>Scholtes, Chapter 3</td>
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<tr>
<td>3</td>
<td>6</td>
<td>Disruptive Group Behavior</td>
<td>Team Building Exercise</td>
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<tr>
<td>4</td>
<td>7</td>
<td>Team Formation and Getting Underway</td>
<td>Scholtes, Chapter 4</td>
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<tr>
<td>4</td>
<td>8</td>
<td>The Responsibility Matrix</td>
<td>Team Building Exercise</td>
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<td>5</td>
<td>9</td>
<td>Building an Improvement Plan</td>
<td>Scholtes, Chapter 5</td>
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<td>5</td>
<td>10</td>
<td>&quot;Scouting&quot;: Observing and Interviewing in Pairs</td>
<td>Team Building Exercise</td>
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<td>6</td>
<td>11</td>
<td>Learning to Work Together</td>
<td>Scholtes, Chapter 6</td>
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<td>6</td>
<td>12</td>
<td>The Living Flowchart</td>
<td>Team Building Exercise</td>
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<td>7</td>
<td>13</td>
<td>Team-Building Activities</td>
<td>Scholtes, Chapter 7</td>
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<td>7</td>
<td>14</td>
<td>Information Hunt--A Preliminary Look at a Process</td>
<td>Team Building Exercise</td>
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<tr>
<td>8</td>
<td>15</td>
<td>Effective Cross-Functional Teams</td>
<td>Parker, Chapters 3-5</td>
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<tr>
<td>8</td>
<td>16</td>
<td>Meeting Skills Checklist</td>
<td>Team Building Exercise</td>
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<tr>
<td>9</td>
<td>17</td>
<td>Effective Cross-Functional Teams</td>
<td>Parker, Chapters 6-9</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>Discussing Your Mission</td>
<td>Team Building Exercise</td>
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<tr>
<td>10</td>
<td>19</td>
<td>Effective Cross-Functional Teams</td>
<td>Parker, Chapters 10-12</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>Observing Group Process</td>
<td>Team Building Exercise</td>
</tr>
</tbody>
</table>

BENEFITS TO STUDENT FACILITATORS
The overwhelming response from student facilitators has been that this experience served as a valuable learning experience for them. Since these students have had some industrial experience, it is apparent to them how the skills they gained from this experience will help them facilitate groups in industry. Probably the best way to describe the benefits to student facilitators to the reader is by sharing direct quotes from their reports. Table 2 presents several student responses concerning how they benefitted from this experience.

**TABLE 2. BENEFITS TO STUDENT FACILITATORS.**

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"Being involved in this class was a good learning experience for me. The biggest thing I learned was to sit back and let someone else take control of the group, even if I don’t agree with the direction the group is heading. This was hard to do at first and I had to constantly fight the urge to try to be the group leader.

It was a new experience for me to be in a group acting as the facilitator. As the facilitator you are trying to make sure that the group acts as one group and not as two or three mini groups. In the first exercise, I was not very good at this, but with experience I learned what was needed. As I got better at being the facilitator, the groups began to get more efficient and function as one group. I also learned to involve all of the members.”

- Andrew Narkiewicz

"As a student in Industrial Engineering, a MECOP (Multiple Engineering Cooperative Program) member, and a corporal (squad commander) in the Army, I have taken on roles of a passive, a neutral, and an aggressive group member. As a facilitator I was given the ability to work with several students who took on similar roles. ... I did not feel that the class as a whole realized that there is a time to be aggressive, a time to be passive, and a time to be neutral. I believe that no time is better than now for the understanding of this concept. I realize that these types of lessons may not be directly related to engineering, and may fall into a communications class stereotype, but the price is going to be high for those students who do not realize the effect that their personalities have on the success or failure of their groups.

The benefits which I received from participating as a facilitator fall into three main categories: leadership abilities, communication skills, and higher awareness of group cohesion. I saw my leadership abilities improve due to the fact that I was not the supreme leader, but played the role of a coach. I took the back seat and watched as the group members worked problems out. I have learned how to identify the proper timing when bringing stray students back on line. I feel that this type of leadership is the most effective and beneficial for everyone. I saw my communication skills enhanced due to this experience. In the past, I communicated well with my peers, but had difficulty communicating technical information to non-peers. From this class, I have learned how to explain ideas and reasoning, as well as being more focused when listening to others. ... From this experience I feel I have become more aware of the working of a successful group. From watching and listening to the successful groups and the unsuccessful groups, I have identified flags which are related to each of the groups’ personalities, and how communication and role playing can be altered to promote the success of the group.”

- Michael Arrigotti
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“Most of the benefits I received from this course were more intangible. For example, I did not learn a new process to solve a linear program that I can show you. However, I do feel I benefitted from this course.

The most important skill when entering the workplace will be the ability to communicate and interact with other people. Being a facilitator directly tries to improve my ability to communicate with other people and be a leader. The more experience I can get in speaking to groups, the more effective I will be in the future.

The facilitation process also allowed me to view group interaction. It reinforced that people see life through many different paradigms. Many times people are trying to communicate the same concept, but cannot see it through the other person’s point of view. This can cause frustration and is a waste of time. It is also important for all group members to participate to get all angles when solving a problem. If one person holds back, that idea may have been the best way to implement a solution.

After forming a group, it is important that the group plans and strategizes before implementing a process or solution. This will allow better maximization of resources available to the group to be used, many times improving the solution. I enjoyed being a facilitator, it was worth my time, and I would do it again.

- Darren Palmberg

SUMMARY

This paper began by describing how continuous improvement efforts identified the need for a course in facilitation. The paper then briefly defined facilitation and how it is distinct from typical project team leadership. The course structure was detailed and the course outline was provided. Finally, the benefits of learning about facilitation were described using quotations from the student reports. The College of Engineering and the Department of Industrial and Manufacturing Engineering at Oregon State are proud of the benefits gained from using the students’ learning experience to contribute to OSUQ (OSU’s Total Quality Management effort) and instructional improvement.

REFERENCES


BIOGRAPHICAL INFORMATION

Kimberly D. Douglas, Ph.D., is an Assistant Professor in Industrial and Manufacturing Engineering at Oregon State University in Corvallis, OR. She received her Ph.D. in Industrial and Management Systems Engineering from Arizona State University and her M.S. and B.S. degrees in Industrial Engineering and Management from Oklahoma State University. Her current research interests include Total Quality Management (TQM), management systems engineering, performance measurement and improvement, and participation. She is a
Thomas M. West, Ph.D., P.E., is the Associate Dean of Engineering and a Professor in Industrial and Manufacturing Engineering at Oregon State University in Corvallis, OR. Prior to joining the faculty at OSU, he held positions with the University of Tennessee, Monsanto Chemicals, and IBM. He is a ABET Program Evaluator for Industrial Engineering and serves as the SME representative on the Engineering Accreditation Commission. His fields of specialization include engineering economic analysis, intermodal transportation systems, and integrated manufacturing systems. He is a member of ASEE, IIE, SME, and IEEE Engineering Management Society.